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Final Report
 Grant NAG5-1756
 Compton GRO Fellowship Program

Principal Investigator: Dr. William S. Paciesas
 Compton GRO Fellow: Dr. Michael S. Briggs

Department of Physics
 University of Alabama in Huntsville
 Huntsville, Alabama 35899
 1995 February 23

1. Gamma-Ray Burst Large-scale Isotropy Analysis:

- Introduced to the field of gamma-ray burst studies two coordinate-system independent tests of isotropy,
- Analyzed BATSE data, deriving limits on Galactic models and testing Galactic models found in the literature.

2. Burst Spectroscopy:

- Wrote spectral analysis software, in use for burst, pulsar and occultation analysis and incorporated into the publically available burst analysis program WINGSPAN.
- Developed automatic line search program. The automatic search is progress.

3. BATSE Gamma-Ray Burst Catalog:

- Assisted in production.
- Assisted in analysis.

4. Selected Publications (additional on attached list):

- ✓ • "Dipole and Quadrupole Tests of the Isotropy of Gamma-Ray Burst Locations", M. S. Briggs, *The Astrophysical Journal*, 407, 126, 1993.
- ✓ • "BATSE Observations of the Large-Scale Isotropy of Gamma-Ray Bursts", M. S. Briggs, W. S. Paciesas, G. N. Pendleton, C. A. Meegan, G. J. Fishman, J. M. Horack, C. Kouveliotou, D. H. Hartmann & J. Hakkila, *The Astrophysical Journal*, submitted, 1994.
- ✓ • "Discovery of a Transient MeV Range Gamma-Ray Source", M. S. Briggs, D. E. Gruber, J. L. Matteson & L. E. Peterson, *The Astrophysical Journal*, 422, 1995.

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Unclass

- 2 • "The Isotropy of Gamma-Ray Bursts: Dipole and Quadrupole Tests", M. S. Briggs, W. S. Paciesas, G. N. Pendleton, G. J. Fishman, C. A. Meegan, R. B. Wilson, M. N. Brock & C. Kouveliotou, in AIP Conf. Proc. #307, Gamma-Ray Bursts, ed. G. J. Fishman, J. J. Brainerd & K. Hurley, 44, 1994.
- 3 • "Limitations on Detecting Dipole and Quadrupole Anisotropies in BATSE's Gamma-Ray Burst Locations", M. S. Briggs, W. S. Paciesas, M. N. Brock, G. J. Fishman, C. A. Meegan & R. B. Wilson, in AIP Conf. Proc. #280, Compton Gamma-Ray Observatory, ed. M. Friedlander, N. Gehrels & D. J. Macomb, 686, 1993.
- 4 • "Coordinate-System-Independent Tests of Isotropy Applied to BATSE's Gamma-Ray Burst Locations", M. S. Briggs, W. S. Paciesas, M. N. Brock, G. J. Fishman, C. A. Meegan & R. B. Wilson, in AIP Conf. Proc. #280, Compton Gamma-Ray Observatory, ed. M. Friedlander, N. Gehrels & D. J. Macomb, 691, 1993.

5. Presentations (Talks and Posters):

- American Astronomical Society, Atlanta, GA, 1992.
- American Physical Society, Washington, D.C., 1992.
- Recent Advances in High Energy Astronomy, Toulouse, France, 1992.
- First Compton Gamma-Ray Observatory, St. Louis, MO, 1992.
- The Evolution of X-Ray Binaries, College Park, MD, 1993.
- American Astronomical Society, Berkeley, CA, 1993.
- The Second Huntsville Gamma-Ray Burst Workshop, Hunstville, AL, 1993.
- Gamma-Ray Bursts, The Aspen Center for Physics, Aspen, CO, 1994.
- Texas Symposium on Relativistic Astrophysics, Munich, Germany, 1994.
- Goddard Space Flight Center, MD.
- University of California in San Diego, CA.
- Russian Institute for Space Research (IKI), Moscow, Russia, 1994.

William S. Paciesas

Dr. William S. Paciesas
Principal Investigator

Michael S. Briggs

Dr. Michael S. Briggs
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Publications
Michael S. Briggs

Journal Articles

1. "BATSE Observations of the Large-Scale Isotropy of Gamma-Ray Bursts", M. S. Briggs, W. S. Paciesas, G. N. Pendleton, C. A. Meegan, G. J. Fishman, J. H. Horack, M. N. Brock, C. Kouveliotou, D. H. Hartmann & J. Hakkila, *The Astrophysical Journal*, submitted, 1995.
2. "Galactic Gamma-Ray Burst Models: Constraints on the Intrinsic Luminosity Function", J. Hakkila, C. A. Meegan, G. N. Pendleton, J. M. Horack, M. S. Briggs, W. S. Paciesas & A. G. Emslie, *The Astrophysical Journal*, submitted, 1995.
3. "Time Dependent Clustering Analysis of the Second BATSE Gamma-Ray Catalog", J. J. Brainerd, C. A. Meegan, M. S. Briggs, G. N. Pendleton & M. N. Brock, *The Astrophysical Journal Letters*, accepted, 1995.
4. "Do Gamma-Ray Burst Sources Repeat?", C. A. Meegan, D. H. Hartmann, J. J. Brainerd, M. S. Briggs, W. S. Paciesas, G. Pendleton, C. Kouveliotou, G. Fishman, G. Blumenthal & M. Brock, *The Astrophysical Journal Letters*, submitted, 1995.
5. "X-Ray/Radio Correlations in X-Ray Nova Scorpii 1994", B. A. Harmon, C. A. Wilson, G. J. Fishman, W. S. Paciesas, M. S. Briggs, S. N. Zhang, B. C. Rubin, D. M. Scott, R. M. Hjellming & M. Rupen, *Nature*, submitted, 1995.
6. " νF_ν Peak Energy Distribution of Gamma-Ray Bursts Observed by BATSE", R. S. Mallozzi, W. S. Paciesas, G. N. Pendleton, M. S. Briggs, R. D. Preece, G. J. Fishman & C. A. Meegan, *The Astrophysical Journal*, submitted, 1995.
7. "The Average Intensity and Spectral Evolution of the BATSE Cosmic Gamma-Ray Bursts", I. G. Mitrofanov, A. M. Cherenko, A. S. Pozanenko, M. S. Briggs, W. S. Paciesas, G. J. Fishman, C. A. Meegan & R. Z. Sagdeev, *The Astrophysical Journal*, submitted, 1995.
8. "Gamma-Ray Burst Precursor Activity as Observed by BATSE", T. M. Koshut, C. Kouveliotou, W. S. Paciesas, J. van Paradijs, G. N. Pendleton, M. S. Briggs, G. J. Fishman & C. A. Meegan, *The Astrophysical Journal*, submitted, 1995.
9. "Discovery of a Transient MeV Range Gamma-Ray Source", M. S. Briggs, D. E. Gruber, J. L. Matteson & L. E. Peterson, *The Astrophysical Journal*, 422, tbd, 1995.

10. "BATSE Observations of Gamma-Ray Burst Spectra. II. Peak Energy Evolution in Bright, Long Bursts" L. A. Ford, D. L. Band, J. L. Matteson, M. S. Briggs, G. N. Pendleton, R. D. Preece, W. S. Paciesas, B. J. Teegarden, D. M. Palmer, B. E. Schaefer, T. L. Cline, G. J. Fishman, C. Kouveliotou, C. A. Meegan, R. B. Wilson & J. P. Lestrade, *The Astrophysical Journal*, **439**, 1995.
11. "The First BATSE Gamma-Ray Burst Catalog", Gerald J. Fishman, Charles A. Meegan, Robert B. Wilson, Martin N. Brock, John M. Horack, Chryssa Kouveliotou, Sethanne Howard, William S. Paciesas, Michael S. Briggs, Geoffrey N. Pendleton, Thomas M. Koshut, Robert S. Mallozzi, Mark Stollberg & John Patrick Lestrade, *The Astrophysical Journal Supplement Series*, **92**, 229, 1994.
12. "BATSE Observations of the Very Intense Gamma-Ray Burst GRB 930131", Chryssa Kouveliotou, Robert Preece, Narayana Bhat, Gerald J. Fishman, Charles A. Meegan, John M. Horack, Michael S. Briggs, William S. Paciesas, Geoffrey N. Pendleton, David Band, Jim Matteson, David Palmer, Bonnard Teegarden & Jay P. Norris, *The Astrophysical Journal Letters*, **422**, 59, 1994.
13. "The Rarity of Soft Gamma-Ray Repeaters Deduced from Reactivation of SGR1806-20°", C. Kouveliotou, G. J. Fishman, C. A. Meegan, W. S. Paciesas, J. van Paradijs, J. P. Norris, R. D. Preece, M. S. Briggs, J. M. Horack, G. N. Pendleton & D. A. Green, *Nature*, **368**, 125, 1994.
14. "BATSE Gamma-Ray Burst Line Search. I. Search for Narrow Lines in Spectroscopy Detector Data", D. M. Palmer, B. J. Teegarden, B. E. Schaefer, T. L. Cline, D. L. Band, L. A. Ford, J. L. Matteson, W. S. Paciesas, G. N. Pendleton, M. S. Briggs, R. D. Preece, G. J. Fishman, C. A. Meegan, R. B. Wilson & J. P. Lestrade, *The Astrophysical Journal Letters*, **433**, 77, 1994.
15. "Observation of GX 339-4 Hard State Outbursts in 1991 and 1992", B. A. Harmon, C. A. Wilson, W. S. Paciesas, G. N. Pendleton, M. S. Briggs, B. C. Rubin, M. H. Finger, G. J. Fishman, M. N. Brock, R. B. Wilson & C. A. Meegan, *The Astrophysical Journal Letters*, **425**, 17, 1994.
16. "The Continuum Spectral Characteristics of Gamma-Ray Bursts Observed by BATSE", G. N. Pendleton, W. S. Paciesas, M. S. Briggs, R. S. Mallozzi, T. M. Koshut, G. J. Fishman, C. A. Meegan, R. B. Wilson, A. B. Harmon & C. Kouveliotou, *The Astrophysical Journal*, **431**, 416, 1994.
17. "BATSE Gamma-Ray Burst Line Search. II. Bayesian Consistency Methodology", D. L. Band, L. A. Ford, J. L. Matteson, M. S. Briggs, W. Paciesas, G. Pendleton, R. Preece, D.

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- ✓ 18. "Dipole and Quadrupole Tests of the Isotropy of Gamma-Ray Burst Locations", Michael S. Briggs, *The Astrophysical Journal*, **407**, 126, 1993.
- ✓ 19. "Identification of Two Classes of Gamma-Ray Bursts", Chryssa Kouveliotou, Charles A. Meegan, Gerald J. Fishman, Narayana P. Bhat, Michael S. Briggs, Thomas M. Koshut, William S. Paciesas & Geoffrey N. Pendleton, *The Astrophysical Journal Letters*, **413**, 101, 1993.
- ✓ 20. "Recurrent Burst Activity from the Soft Gamma-Ray Repeater SGR 1900+14", C. Kouveliotou, G. J. Fishman, C. A. Meegan, W. S. Paciesas, R. B. Wilson, J. van Paradijs, R. D. Preece, M. S. Briggs, G. N. Pendleton, M. N. Brock, T. M. Koshut & J. M. Horack, *Nature*, **362**, 728, 1993.
- ✓ 21. "BATSE Observations of Gamma-Ray Burst Spectra. I. Spectral Diversity", D. Band, J. Matteson, L. Ford, B. Schaefer, D. Palmer, B. Teegarden, T. Cline, M. Briggs, W. Paciesas, G. Pendleton, G. Fishman, C. Kouveliotou, C. Meegan, R. Wilson & P. Lestrade, *The Astrophysical Journal*, **413**, 281, 1993.
- ✓ 22. "Compton-Backscattered Annihilation Radiation from the Galactic Center Region", D. M. Smith, R. P. Lin, P. Feffer, S. Slassi, K. Hurley, J. Matteson, H. B. Bowman, R. M. Pelling, M. Briggs, D. Gruber, L. E. Peterson, P. von Ballmoos, I. Malet, M. Niel, G. Vedeninne, P. Durouchoux, P. Wallyn, C. Chapuis, C. Cork, D. Landis, P. Luke, N. Madden, D. Malone & R. Pehl, *The Astrophysical Journal*, **414**, 165, 1993.
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- ✓ 24. "An Investigation into the Electron-Proton Discrimination Capabilities of Ionization Calorimeters", M. S. Briggs, *Nuclear Instruments and Methods*, **200**, 463, 1982.

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26. "Analysis of the Second BATSE Catalog", C. A. Meegan, G. J. Fishman, J. M. Horack, M. N. Brock, S. Cole, W. S. Paciesas, J. J. Brainerd, M. S. Briggs, G. N. Pendleton, R.

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27. "Two and a Half Years of BATSE Observations", C. Meegan, G. Fishman, R. Wilson, M. Brock, J. Horrack, W. Paciesas, G. Pendleton, M. S. Briggs, T. Koshut, C. Kouveliotou, B. Teegarden, J. Matteson, J. Hakkila, in AIP Conf. Proc. #307, Gamma-Ray Bursts, ed. G. J. Fishman, J. J. Brainerd & K. Hurley, 3, 1994.
28. "The Isotropy of Gamma-Ray Bursts: Dipole and Quadrupole Tests", M. S. Briggs, W. S. Paciesas, G. N. Pendleton, G. J. Fishman, C. A. Meegan, R. B. Wilson, M. N. Brock & C. Kouveliotou, in AIP Conf. Proc. #307, Gamma-Ray Bursts, ed. G. J. Fishman, J. J. Brainerd & K. Hurley, 44, 1994.
29. "Additional Constraints on Galactic Coronal/Extended Halo Source Distributions from BATSE Observations", J. Hakkila, C. A. Meegan, G. J. Fishman, R. B. Wilson, M. N. Brock, J. M. Horack & G. N. Pendleton, in AIP Conf. Proc. #307, Gamma-Ray Bursts, ed. G. J. Fishman, J. J. Brainerd & K. Hurley, 59, 1994.
30. "Do Classical Gamma-Ray Bursts Repeat?", D. H. Hartmann, G. R. Blumenthal, K. Hurley, E. V. Linder, J. Hakkila, G. J. Fishman, C. A. Meegan, R. B. Wilson, M. Brock, J. M. Horack, C. Kouveliotou, M. S. Briggs, W. S. Paciesas & G. N. Pendleton, in AIP Conf. Proc. #307, Gamma-Ray Bursts, ed. G. J. Fishman, J. J. Brainerd & K. Hurley, 127, 1994.
31. "Two Classes of Gamma-Ray Bursts", C. Kouveliotou, C. A. Meegan, G. J. Fishman, P. N. Bhat, M. S. Briggs, T. M. Koshut, W. S. Paciesas & G. N. Pendleton, in AIP Conf. Proc. #307, Gamma-Ray Bursts, ed. G. J. Fishman, J. J. Brainerd & K. Hurley, 167, 1994.
32. "Gamma-Ray Burst Variability: A Search for Correlations with Other Parameters", J. P. Lestrade, M. Briggs, W. S. Paciesas, G. J. Fishman, C. A. Meegan & R. B. Wilson, in AIP Conf. Proc. #307, Gamma-Ray Bursts, ed. G. J. Fishman, J. J. Brainerd & K. Hurley, 212, 1994.
33. "The Search for Gamma-Ray Burst Spectral Features in the COMPTON GRO BATSE Data", D. M. Palmer, B. J. Teegarden, B. E. Schaefer, T. L. Cline, D. L. Band, L. A. Ford, J. L. Matteson, R. D. Preece, W. S. Paciesas, G. N. Pendleton, M. S. Briggs, G. J. Fishman, C. A. Meegan, R. B. Wilson & J. P. Lestrade, in AIP Conf. Proc. #307, Gamma-Ray Bursts, ed. G. J. Fishman, J. J. Brainerd & K. Hurley, 247, 1994.
34. "Cyclotron Line Search: BATSE-GINGA Consistency", D. Band, L. Ford, J. Matteson, D. Palmer, B. Teegarden, B. Schaefer, M. S. Briggs, W. Paciesas, G. Pendleton & R.

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36. "Consistency Analysis of a Candidate Line Feature in GRB930506", R. Preece, M. S. Briggs, W. Paciesas, G. Pendleton, L. Ford, D. Band, J. Matteson, D. Palmer, B. Teegarden, B. Schaefer & M. Brock, in AIP Conf. Proc. #307, Gamma-Ray Bursts, ed. G. J. Fishman, J. J. Brainerd & K. Hurley, 266, 1994.
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38. "A Study of Continuum Spectra of Short-Duration Gamma-Ray Bursts Observed by BATSE", T. M. Koshut, G. N. Pendleton, R. S. Mallozzi, W. S. Paciesas & M. S. Briggs, in AIP Conf. Proc. #307, Gamma-Ray Bursts, ed. G. J. Fishman, J. J. Brainerd & K. Hurley, 303, 1994.
39. "The Energy Emission of Gamma-Ray Bursts and Solar Flares", R. S. Mallozzi, G. N. Pendleton, T. M. Koshut, W. S. Paciesas & M. S. Briggs, in AIP Conf. Proc. #307, Gamma-Ray Bursts, ed. G. J. Fishman, J. J. Brainerd & K. Hurley, 308, 1994.
40. "Continuum Spectral Characteristics of Bursts Measured with the BATSE Large Area Detectors", G. N. Pendleton, W. S. Paciesas, M. S. Briggs, G. J. Fishman, R. B. Wilson, C. A. Meegan & C. Kouveliotou, in AIP Conf. Proc. #307, Gamma-Ray Bursts, ed. G. J. Fishman, J. J. Brainerd & K. Hurley, 313, 1994.
41. "Spectral Curvature in High-Energy Gamma-Ray Bursts Observed by the BATSE Large Area Detectors", R. D. Preece, M. S. Briggs, W. S. Paciesas, G. N. Pendleton, C. Kouveliotou & M. N. Brock, in AIP Conf. Proc. #307, Gamma-Ray Bursts, ed. G. J. Fishman, J. J. Brainerd & K. Hurley, 318, 1994.
42. "The Kapteyn (Lognormal) Distribution as a Model of GRB Spectra and Pulse Profiles", M. Brock, C. Meegan, R. Wilson, C. Kouveliotou, W. Paciesas, G. Pendleton, M. S. Briggs & R. Preece, in AIP Conf. Proc. #307, Gamma-Ray Bursts, ed. G. J. Fishman, J. J. Brainerd & K. Hurley, 672, 1994.

43. "Using Contour Maps to Search for Red-Shifted 511 keV Features in BATSE GRB Spectra", P. G. Varmette, J. P. Lestrade, G. J. Fishman, C. A. Meegan, M. N. Brock, R. D. Preece, M. S. Briggs, G. N. Pendleton & W. S. Paciesas, in AIP Conf. Proc. #307, Gamma-Ray Bursts, ed. G. J. Fishman, J. J. Brainerd & K. Hurley, 711, 1994.
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45. "A Transient MeV Range Gamma-Ray Source Discovered by HEAO-1", M. S. Briggs, D. E. Gruber, J. L. Matteson & L. E. Peterson, in AIP Conf. Proc. #304, The Second Compton Symposium, ed. C. E. Fichtel, N. Gehrels & J. P. Norris, 255, 1994.
46. "BATSE Discovery of a Hard X-Ray Pulsar: GRO J1008-57", R. B. Wilson, B. A. Harmon, G. J. Fishman, M. H. Finger, M. T. Stollberg, G. N. Pendleton, M. Briggs, T. A. Prince, L. Bildsten, D. Chakrabarty, B. C. Rubin & N. S. Zhang, in AIP Conf. Proc. #304, The Second Compton Symposium, ed. C. E. Fichtel, N. Gehrels & J. P. Norris, 390, 1994.
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51. "Observation of a Correlation between Main-On Intensity and Spin Behaviour in Her X-1", R. B. Wilson, M. H. Finger, G. N. Pendleton, M. S. Briggs & L. Bildsten, in

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54. "Limitations on Detecting Dipole and Quadrupole Anisotropies in BATSE's Gamma-Ray Burst Locations", M. S. Briggs, W. S. Paciesas, M. N. Brock, G. J. Fishman, C. A. Meegan & R. B. Wilson, in AIP Conf. Proc. #280, Compton Gamma-Ray Observatory, ed. M. Friedlander, N. Gehrels & D. J. Macomb, 686, 1993.
55. "Coordinate-System-Independent Tests of Isotropy Applied to BATSE's Gamma-Ray Burst Locations", M. S. Briggs, W. S. Paciesas, M. N. Brock, G. J. Fishman, C. A. Meegan & R. B. Wilson, in AIP Conf. Proc. #280, Compton Gamma-Ray Observatory, ed. M. Friedlander, N. Gehrels & D. J. Macomb, 691, 1993.
56. "Preliminary Angular Correlation Analyses of Gamma-Ray Bursts Detected by BATSE", J. M. Horack, G. J. Fishman, C. A. Meegan, R. B. Wilson, M. N. Brock, J. Hakkila, W. S. Paciesas, G. N. Pendleton & M. S. Briggs, in AIP Conf. Proc. #280, Compton Gamma-Ray Observatory, ed. M. Friedlander, N. Gehrels & D. J. Macomb, 699, 1993.
57. "Search for Gamma-Ray Burst Spectral Features in the Compton GRO BATSE Data", B. J. Teegarden, T. L. Cline, D. Palmer, B. E. Schaefer, G. J. Fishman, C. Meegan, R. B. Wilson, M. Briggs, W. S. Paciesas, G. Pendleton, D. L. Band, L. Ford & J. L. Matteson, in AIP Conf. Proc. #280, Compton Gamma-Ray Observatory, ed. M. Friedlander, N. Gehrels & D. J. Macomb, 860, 1993.
58. "Searching for GRB Spectral Features in the BATSE Large Area Detector Data", R. D. Preece, G. J. Fishman, C. A. Meegan, R. B. Wilson, M. N. Brock, W. S. Paciesas, G. N. Pendleton, M. S. Briggs & B. Teegarden, in AIP Conf. Proc. #280, Compton Gamma-Ray Observatory, ed. M. Friedlander, N. Gehrels & D. J. Macomb, 867, 1993.
59. "BATSE Observations of a Soft Gamma Repeater (SGR)", C. Kouveliotou, G. J. Fishman, C. A. Meegan, R. B. Wilson, R. D. Preece, J. M. Horack, W. S. Paciesas, M. S. Briggs, T. M. Koshut & J. van Paradijs, in AIP Conf. Proc. #280, Compton Gamma-Ray Observatory, ed. M. Friedlander, N. Gehrels & D. J. Macomb, 882, 1993.

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